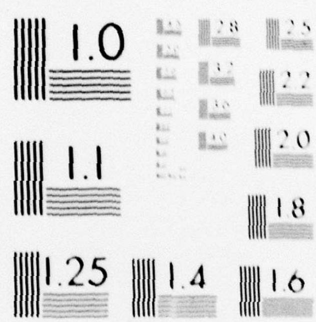
AD-A054 795 FEDERAL AVIATION ADMINISTRATION WASHINGTON D C OFFICE--ETC F/G 5/10
EXPERIMENTAL ATTEMPTS TO EVOKE A DIFFERENTIAL RESPONSE TO DIFFE--ETC(U)
APR 78 C E MELTON, J M MCKENZIE, J T SALDIVAR

UNCLASSIFIED FAA-AM-78-18 NL

1 OF 1
AD
A054 795

END
DATE
FILMED
7-78
DDC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FOR FURTHER TRAN

FAA-AM-78-18

EXPERIMENTAL ATTEMPTS TO EVOKE A DIFFERENTIAL RESPONSE TO DIFFERENT STRESSORS

C. E. Melton
J. M. McKenzie
J. T. Saldivar
S. M. Wicks

Civil Aeromedical Institute
Federal Aviation Administration
Oklahoma City, Oklahoma

April 1978

Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

Prepared for
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Office of Aviation Medicine
Washington, D.C. 20591

78 06 08 043

Technical Report Documentation Page

14

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-AM-78-18		

4. Title and Subtitle	5. Report Date
6 EXPERIMENTAL ATTEMPTS TO EVOKE A DIFFERENTIAL RESPONSE TO DIFFERENT STRESSORS	
	6. Performing Organization Code
7. Author(s) 10 C. E. Melton, J. M. McKenzie, J. T. Saldivar, S. M. Wicks	8. Performing Organization Report No.
9. Performing Organization Name and Address FAA Civil Aeromedical Institute P. O. Box 25082 Oklahoma City, Oklahoma 73125	10. Work Unit No. (TRAIS)
	11. Contract or Grant No.
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Office of Aviation Medicine Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D.C. 20591	11 Apr 78
	14. Sponsoring Agency Code

15. Supplementary Notes

Work was performed under Task AM-C-77-PHY-103.

12 7p.

16. Abstract

Ten paid male subjects each worked at a physical task with no competitive element (treadmill) and a competitive task ("Pong") with minimal physical activity. There were three work periods, each 50 min long. Ten minutes were allowed for rest and urine collection after each work period. The experimental period lasted 3 h. Urine was analyzed for 17-ketogenic steroids (17-KGS), epinephrine (E), and norepinephrine (NE). Heart rates were derived from ambulatory electrocardiograms. There were no statistically significant differences in excretion of urinary metabolites during corresponding episodes of the two tasks. Heart rates were significantly higher during treadmill work than during Pong playing. Rest-to-work differences show that the increment in E excretion is significantly greater during the Pong task than during the treadmill task. Rest-to-work differences in excretion of 17-KGS and NE are not significant. The rest-to-work increase in heart rate is significant for treadmill, but not for Pong. The increase in epinephrine excretion strengthens the conclusion drawn from field experiments that this measurement is the best indicator of the intensity of air traffic control work *per se*.

17. Key Words	18. Distribution Statement
Stress Urinary Metabolites Air Traffic Controllers	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	5	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

78 06 08 043

264 320

EXPERIMENTAL ATTEMPTS TO EVOKE A DIFFERENTIAL RESPONSE TO DIFFERENT STRESSORS

I. Introduction.

The physiological response to real-life stressors, as determined by a battery of measurements, is difficult to interpret. Invariably, a mixture of stressors is involved, some related to the work situation, others to personal matters. The response is similarly mixed and not always clearly related to known stressors. Interpretations of the real-life stress response would be substantially improved if physiological and biochemical responses to "pure" stressors could be defined. These experiments were carried out with the goal of providing such data.

II. Methods.

Ten paid men ranging in age from 19 to 26 years (average 21.9 years) served as subjects in the experiment. Each was given a medical examination including a treadmill tolerance test, was apprised of the purposes of the experiment, was told of the approaches to be used, and was required to sign an informed consent document before being accepted as a subject.

Each subject was challenged with two tasks; one was purely physical with no competitive element (treadmill), the other was a competitive task that required minimal physical activity ("Pong"). Order of presentation of the tasks was balanced. In each task, subjects were required to work in 50-min episodes. In the 10 min following each work episode, urine collections were made, rest was allowed, and water was imbibed to replace urinary loss. This schedule for each task was maintained for 3 h. The treadmill was set at 3 miles per hour with no grade.

"Pong" is an electronic game based on ping-pong. The game is displayed on a television screen. A "ball" is automatically and randomly directed to one side of the display. Each of two players, using a control knob on the game console, controls a "bat" on one side of the display. The players attempt to intercept the ball with the bat, thus returning the ball to the opponent. When a player misses the ball, a point is automatically scored for the opponent. The cumulative score of each player is displayed after each point. The first player to score 15 points wins the game. One of the researchers acted as opponent for all the subjects; she was an expert at the game and was rarely beaten.

On arrival at the laboratory, subjects were requested to void urine and discard it. They then had electrocardiographic electrodes attached to their chests, were given 250 ml of water to drink, and were asked to rest in the supine position on a cot for 50 min. At the end of the rest period, subjects collected a urine specimen and began the first work episode.

The electrocardiogram was recorded on an Avionics Electrocardiocorder for continuous registration of heart rate. Urine specimens were collected in a 500-ml graduate cylinder, the volume was recorded, and aliquots were taken for analysis of 17-ketogenic steroids (17-KGS), epinephrine (E), and norepinephrine (NE). Aliquots were kept frozen in a freezer until analyzed. Urinary stress hormone values are expressed as total weights of the substances excreted during each 50-min episode.

III. Results.

The results of urine and heart rate analyses are shown in Tables 1 and 2. There are no statistically significant differences in levels of urinary metabolite excretion for corresponding episodes of the two tasks. Heart rates are significantly higher for the treadmill than for the Pong task (Table 1). Rest-to-work differences show that the increment in E excretion is significantly greater during the Pong task than during the treadmill task. Rest-to-work differences in excretion of 17-KGS and NE are not significant for either task. The rest-to-work increase in heart rate is significant for the treadmill but not for the Pong task (Table 2).

IV. Discussion.

Field experiments have shown that epinephrine excretion is significantly related to traffic count and to radio transmission time (1). The data have strongly suggested that adrenal steroid excretion is related to chronic stressors such as labor-management difficulties (2,3) and that norepinephrine excretion is related to physical activity (4). These experiments strengthen the interpretation that epinephrine excretion is related to mental tasks (5) such as air traffic control and not to physical tasks and therefore is the best single indicator of response to air traffic control work *per se*.

TABLE 1. Comparison of Excretion Values and Heart Rates for Pong and Treadmill Tasks*

Task	Total Amounts of Hormones Excreted 17-KGS mg	E ng	NE ng	Heart Rate (Beats Per Minute)
Rest (Pong)	0.70	1,237	3,603	64
Rest (T-Mill)	0.67	1,214	4,274	64
P	NS**	NS	NS	NS
Pong 1	0.70	1,619	3,809	73
T-Mill 1	0.59	1,741	4,384	101
P	NS	NS	NS	0.05
Pong 2	0.62	1,720	3,379	73
T-Mill 2	0.67	1,463	3,813	100
P	NS	NS	NS	0.05
Pong 3	0.59	1,750	3,833	70
T-Mill 3	0.58	1,491	3,581	98
P	NS	NS	NS	0.01

* Group Averages
** T-test

TABLE 2. Statistical Significance of Rest-To-Work Differences for the Various Measurements*

	Level of Significance of Difference Between Rest and Task (P**)			
TASK	17-KGS	E	NE	HEART RATE
Pong 1	NS	0.01	NS	NS
Pong 2	NS	0.01	NS	NS
Pong 3	NS	0.05	NS	NS
T-Mill 1	NS	NS	NS	0.01
T-Mill 2	NS	NS	NS	0.01
T-Mill 3	NS	NS	NS	0.01

* See Table 1 for actual values.

** Paired t-test

REFERENCES

1. Melton, C. E., J. M. McKenzie, J. T. Saldivar, and S. M. Hoffmann: Comparison of Opa Locka Tower With Other ATC Facilities by Means of a Stress Index, FAA Office of Aviation Medicine Report No. AM-74-11, 1974.

2. Melton, C. E., J. M. McKenzie, J. T. Saldivar, and Marlene Hoffmann: Studies on Stress in Aviation Personnel: Analysis and Presentation of Data Derived From a Battery of Measurements, Advisory Group for Aerospace Research and Development No. CPP-180, 1975.

3. Kagan, A. R., and L. Levi: Health and Environment - Psychosocial Stimuli, A Review. Reports from the Laboratory for Clinical Stress Research No. 27, December 1971.

4. Adkins, J. R., T. I. Miller, T. Carter, and J. D. Hardy: The Hormonal Mediation of Neurovascular Reflex Adjustments: Catecholamine Response to Postural Changes in Man, AMER. J. SURG., 27:210, 1961.

5. Pátkai, P.: Catecholamine Excretion in Pleasant and Unpleasant Situations, ACTA PSYCHOLOGICA, 35:352-363, 1971.